RLA LIFTING ANCHORS

DESIGN ACCORDING TO EUROCODES

R-STEEL®

RLA LIFTING ANCHORS

www.rsteel.fi 9.12.2013

1 DESCRIPTION OF THE SYSTEM

RLA lifting anchors are studded steel parts used in lifting of concrete elements.

2 DIMENSIONS AND MATERIALS

2.1 DIMENSIONS AND TOLERANCES

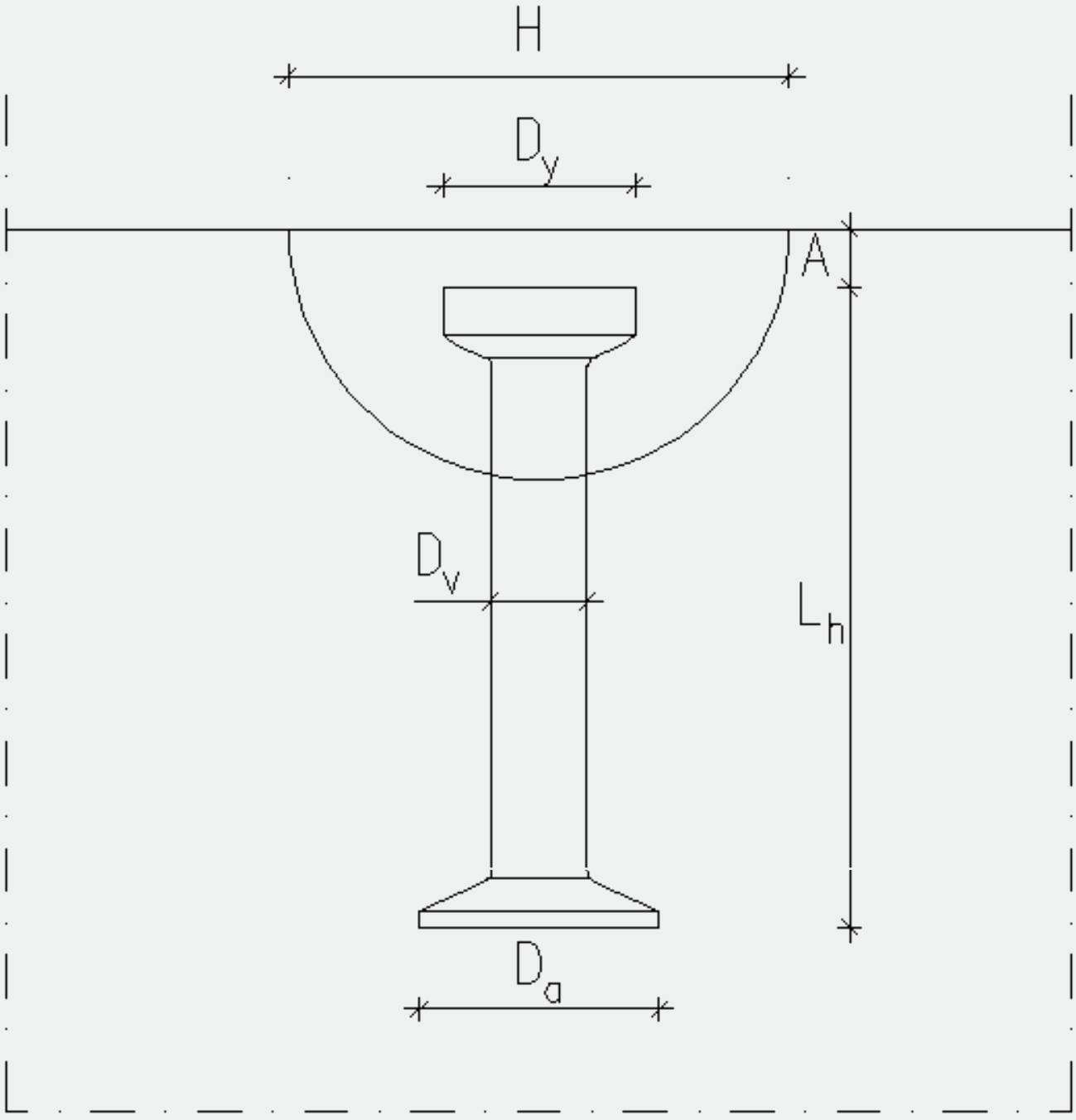


FIGURE 1 | *Dimensions of RLA lifting anchors*

TABLE 1 | DIMENSIONS AND TOLERANCES OF RLA LIFTING ANCHORS

Lifting anchor	Diameter D_y	±	Diameter D_v	±	Diameter D_a	±	Length L_h	±	Installation depth A	Diameter H
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
RLA 1.3- 40							40			
RLA 1.3- 50							50			
RLA 1.3- 65	19	0.5	10	0.2	25	1.0	65	2.0	10	60
RLA 1.3- 85							85			
RLA 1.3- 120							120			
RLA 2.5- 55							55			
RLA 2.5- 65							65			
RLA 2.5- 85	26	0.5	14	0.2	35	1.0	85	2.0	11	74
RLA 2.5- 120							120			
RLA 2.5- 170							170			
RLA 4.0- 75							75			
RLA 4.0- 100							100			
RLA 4.0- 120	36	0.5	18	0.2	45	1.0	120	2.0	15	94
RLA 4.0- 170							170			
RLA 4.0- 210							210			
RLA 4.0- 340							340			
RLA 5.0- 85							85			
RLA 5.0- 95							95			
RLA 5.0- 120	36	0.5	20	0.2	50	1.0	120	2.0	15	94
RLA 5.0- 180							180			
RLA 5.0- 240							240			
RLA 7.5- 100							100			
RLA 7.5- 120							120			
RLA 7.5- 140	47	0.5	24	0.2	60	1.0	140	2.0	15	118
RLA 7.5- 165							165			
RLA 7.5- 200							200			
RLA 7.5- 300							300			
RLA 10- 115							115			
RLA 10- 135							135			
RLA 10- 150	47	0.5	28	0.2	70	1.0	150	3.0	15	118
RLA 10- 170							170			
RLA 10- 250							250			
RLA 10- 340							340			

Lifting anchor	Diameter D_y [mm]	± [mm]	Diameter D_v [mm]	± [mm]	Diameter D_a [mm]	± [mm]	Length L_h [mm]	± [mm]	Installation depth A [mm]	Diameter H [mm]
RLA 15- 140							140			
RLA 15- 165							165			
RLA 15- 200	69	0.5	34	0.3	85	1.2	200	3.0	15	160
RLA 15- 300							300			
RLA 15- 400							400			
RLA 20- 200							200			
RLA 20- 240							240			
RLA 20- 250	70	0.5	39	0.5	98	1.5	250	3.0	15	160
RLA 20- 340							340			
RLA 20- 500							500			

2.2 MATERIALS AND STANDARDS

TABLE 2 | MATERIALS AND STANDARDS

Part	Ordering code	Material	Standard
Lifting anchor	RLA	S355J2+N	SFS-EN 10025
	RLAz	S355J2+N	SFS-EN 10025
	RLAr	1.4301	SFS-EN 10088
	RLAh	1.4401	SFS-EN 10088

2.3 ORDERING CODE

TABLE 3 | ORDERING CODE AND TYPE

Ordering code	Type
RLA	Plain
RLAz	Hot zinced
RLAr	Stainless
RLAh	Acid resistant

Ordering code consists of type, size and length of RLA lifting anchor.

Eg. RLA15-300 is plain 300 mm long lifting anchor.

3 MANUFACTURING

3.1 MANUFACTURING METHOD

Lifting anchor is mechanically cut from a steel rod and ends are studded.

3.2 MANUFACTURING MARKINGS

Product package is equipped with a R-Steel –sticker, which contains the following information: product type, product name, quantity ISO9001 and ISO14001 quality and environment system markings, FI marking and product picture.

Products are delivered in cardboard boxes on a truck palette. Cardboard boxes are marked with FI and BY (Concrete Association of Finland) logo and the number of certified product declaration, numbers of the ISO-certificates and the product type and name

3.3 QUALITY CONTROL

Quality control of the inserts is done according to the requirements of the Finnish Code of Building Regulations and the instructions according to quality and environment system of the R-Group Finland Oy (ISO9001 and ISO14001). R-Group Finland Oy has a quality control contract with Inspecta Sertifiointi Oy.

4 RESISTANCES

4.1 DESIGN PRINCIPLES

Resistances of the RLA lifting anchors are calculated for static loads according to the limit state dimensioning method presented in Eurocodes.

The calculations are made according to the following regulations and instructions:

SFS-EN 1992: Eurocode 2: Design of concrete structures

CEN/TS 1992-4-2 Design of fastenings for use in concrete

VDI/BV-BS 6205

Resistances are the same for all types of RLA anchors (RLA, RLAz, RLAr, RLAh).

Resistances are calculated for concrete strengths C16/20 and C25/30.

Resistances given in tables 4 and 5 are allowed loads with safety factors according to chapter 4.2.

F_{Ed} = load for one RLA anchor (see chapter 5.4).

F_{Rd} = resistance of one RLA anchor (see tables 4 and 5).

$F_{Ed} \leq F_{Rd}$

4.2 SAFETY FACTORS

Material safety factors for RLA lifting anchors are:

Steel (anchor material):	γs = 3,0
Concrete:	γc = 2,5
Load safety factor:	γload = 1,0

4.3 RESISTANCES AND EDGE DISTANCES IN WALL STRUCTURES

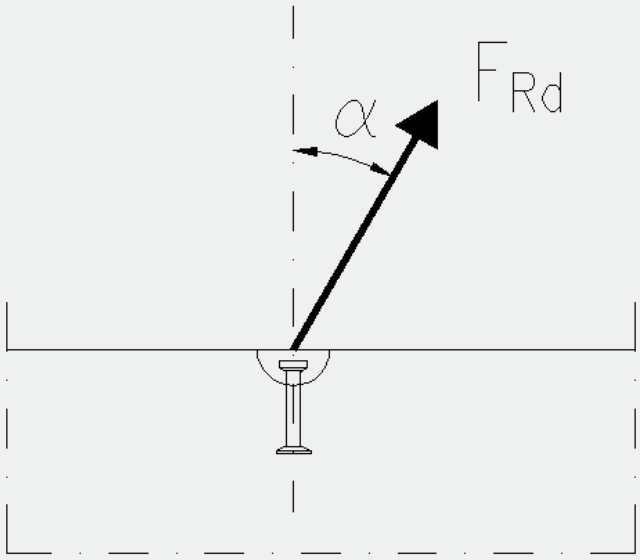


FIGURE 2 | *Lifting angle α*

Greatest allowed lifting angle α is 60°.

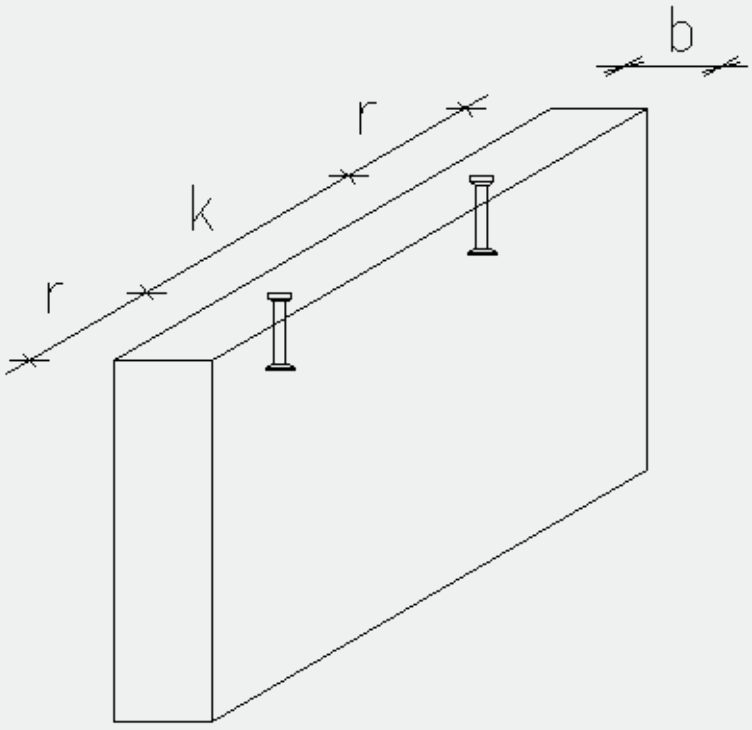


FIGURE 3 | *RLA lifting anchor in wall*

TABLE 4 | RESISTANCES AND EDGE DISTANCES IN WALL STRUCTURES WHEN α = 0...45°

Lifting anchor	Edge distance r [mm]	Center distance k [mm]	Resistance F_{Rd} [kN] with reinforcement 1			Resistance F_{Rd} [kN] with reinforcement 2		
			Wall b [mm]	Concrete C16/20	C25/30	Wall b [mm]	Concrete C16/20	C25/30
RLA 1.3- 40	72	144	80	3.6	4.9	80	7.2	9.7
			100	3.6	4.9	100	7.2	9.7
			120	3.6	4.9	120	7.2	9.7
RLA 1.3- 50	87	174	80	4.9	6.6	80	8.3	10.1
			100	4.9	6.6	100	9.8	12.6
			120	4.9	6.6	120	9.8	12.6
RLA 1.3- 65	110	219	80	6.9	9.2	80	8.3	10.1
			100	6.9	9.2	100	11.0	12.6
			120	6.9	9.2	120	12.6	12.6
RLA 1.3- 85	140	279	80	8.3	10.1	80	8.3	10.1
			100	9.4	12.6	100	11.0	12.6
			120	9.4	12.6	120	12.6	12.6
RLA 1.3- 120	192	384	80	8.3	10.1	80	8.3	10.1
			100	11.0	12.6	100	11.0	12.6
			120	12.6	12.6	120	12.6	12.6
RLA 2.5- 55	93	186	80	7.2	9.7	80	10.9	14.6
			100	7.2	9.7	100	10.9	14.6
			120	7.2	9.7	120	10.9	14.6
RLA 2.5- 65	108	216	80	9.0	12.1	80	13.4	18.1
			100	9.0	12.1	100	13.4	18.1
			120	9.0	12.1	120	13.4	18.1
RLA 2.5- 85	138	276	80	12.4	16.7	80	15.7	19.2
			100	12.4	16.7	100	18.6	24.0
			120	12.4	16.7	120	18.6	24.4
RLA 2.5- 120	191	381	80	15.7	19.2	80	15.7	19.2
			100	18.4	24.0	100	19.6	24.0
			120	18.4	24.4	120	23.5	24.4
RLA 2.5- 170	266	531	80	15.7	19.2	80	15.7	19.2
			100	19.6	24.0	100	19.6	24.0
			120	23.5	24.4	120	23.5	24.4
RLA 4.0- 75	123	246	120	10.7	14.4	120	21.4	28.8
			140	10.7	14.4	140	21.4	28.8
			160	10.7	14.4	160	21.4	28.8
RLA 4.0- 100	161	321	100	15.0	20.2	100	25.4	31.1
			120	15.0	20.2	120	30.0	37.3
			140	15.0	20.2	140	30.0	40.4
RLA 4.0- 120	191	381	100	18.4	24.8	100	25.4	31.1
			120	18.4	24.8	120	30.5	37.3
			140	18.4	24.8	140	35.6	40.6
RLA 4.0- 170	266	531	100	25.4	31.1	100	25.4	31.1
			120	27.1	36.4	120	41.5	41.5
			140	27.1	36.4	140	35.6	40.6

Lifting anchor	Edge distance r [mm]	Center distance k [mm]	Resistance F_{Rd} [kN] with reinforcement 1 Wall b [mm]	Concrete C16/20	Concrete C25/30	Resistance F_{Rd} [kN] with reinforcement 2 Wall b [mm]	Concrete C16/20	Concrete C25/30
RLA 4.0- 210	326	651	100	25.4	31.1	100	25.4	31.1
			120	30.5	36.9	120	30.5	37.3
			140	34.0	36.9	140	35.6	40.6
RLA 4.0- 340	521	1041	100	25.4	31.1	100	25.4	31.1
			120	30.5	36.9	120	30.5	37.3
			140	35.6	36.9	140	35.6	40.6
RLA 5.0- 85	138	276	160	15.5	20.9	160	31.0	41.8
			180	15.5	20.9	180	31.0	41.8
			200	15.5	20.9	200	31.0	41.8
RLA 5.0- 95	153	306	160	17.7	23.8	160	35.3	47.6
			180	17.7	23.8	180	35.3	47.6
			200	17.7	23.8	200	35.3	47.6
RLA 5.0- 120	191	381	160	23.1	31.0	160	45.3	50.3
			180	23.1	31.0	180	46.1	50.3
			200	23.1	31.0	200	46.1	50.3
RLA 5.0- 180	281	561	160	36.0	48.4	160	45.3	50.3
			180	36.0	48.4	180	50.3	50.3
			200	36.0	48.4	200	50.3	50.3
RLA 5.0- 240	371	741	160	45.3	50.3	160	45.3	50.3
			180	48.9	50.3	180	50.3	50.3
			200	48.9	50.3	200	50.3	50.3
RLA 7.5- 100	158	315	160	18.3	24.7	160	36.6	49.3
			180	18.3	24.7	180	36.6	49.3
			200	18.3	24.7	200	36.6	49.3
RLA 7.5- 120	188	375	160	22.6	30.5	160	45.2	60.9
			180	22.6	30.5	180	45.2	60.9
			200	22.6	30.5	200	45.2	60.9
RLA 7.5- 140	218	435	160	26.9	36.3	160	53.9	66.9
			180	26.9	36.3	180	53.9	72.5
			200	26.9	36.3	200	53.9	72.5
RLA 7.5- 165	255	510	160	32.3	43.5	160	54.6	66.9
			180	32.3	43.5	180	61.4	72.7
			200	32.3	43.5	200	64.6	72.7
RLA 7.5- 200	308	615	160	39.9	53.7	160	54.6	66.9
			180	39.9	53.7	180	61.4	72.7
			200	39.9	53.7	200	68.2	72.7
RLA 7.5- 300	458	915	160	54.6	57.6	160	54.6	66.9
			180	57.6	57.6	180	61.4	72.7
			200	57.6	57.6	200	68.2	72.7
RLA 10- 115	179	357	200	25.6	34.5	200	51.2	68.9
			240	25.6	34.5	240	51.2	68.9
			280	25.6	34.5	280	51.2	68.9
RLA 10- 135	209	417	200	30.8	41.4	200	61.5	82.8
			240	30.8	41.4	240	61.5	82.8
			280	30.8	41.4	280	61.5	82.8

Lifting anchor	Edge distance r [mm]	Center distance k [mm]	Resistance F_{Rd} [kN] with reinforcement 1 Wall b [mm]	Concrete C16/20	Concrete C25/30	Resistance F_{Rd} [kN] with reinforcement 2 Wall b [mm]	Concrete C16/20	Concrete C25/30
RLA 10- 150	231	462	200	34.6	46.6	200	69.3	93.3
			240	34.6	46.6	240	69.3	93.3
			280	34.6	46.6	280	69.3	93.3
RLA 10- 170	261	522	200	39.8	53.6	200	79.6	97.8
			240	39.8	53.6	240	79.6	99.1
			280	39.8	53.6	280	79.6	99.1
RLA 10- 250	381	762	200	60.5	81.5	200	79.9	97.8
			240	60.5	81.5	240	95.8	99.1
			280	60.5	81.5	280	99.1	99.1
RLA 10- 340	516	1032	200	79.9	82.9	200	79.9	97.8
			240	82.9	82.9	240	95.8	99.1
			280	82.9	82.9	280	99.1	99.1
RLA 15- 140	215	431	300	31.9	43.0	300	63.9	86.0
			400	31.9	43.0	400	63.9	86.0
			500	31.9	43.0	500	63.9	86.0
RLA 15- 165	253	506	300	38.4	51.7	300	76.8	103.4
			400	38.4	51.7	400	76.8	103.4
			500	38.4	51.7	500	76.8	103.4
RLA 15- 200	305	611	300	47.4	63.9	300	94.9	127.8
			400	47.4	63.9	400	94.9	127.8
			500	47.4	63.9	500	94.9	127.8
RLA 15- 300	455	911	300	73.3	82.9	300	145.5	146.6
			400	73.3	82.9	400	146.6	146.6
			500	73.3	82.9	500	146.6	146.6
RLA 15- 400	605	1211	300	82.9	82.9	300	145.5	146.6
			400	82.9	82.9	400	146.6	146.6
			500	82.9	82.9	500	146.6	146.6
RLA 20- 200	303	606	300	94.1	126.7	300	141.2	190.1
			400	94.1	126.7	400	141.2	190.1
			500	94.1	126.7	500	141.2	190.1
RLA 20- 240	363	726	300	114.8	154.6	300	167.5	190.1
			400	114.8	154.6	400	172.2	190.1
			500	114.8	154.6	500	172.2	190.1
RLA 20- 250	378	756	300	120.0	161.5	300	167.5	190.1
			400	120.0	161.5	400	179.9	190.1
			500	120.0	161.5	500	179.9	190.1
RLA 20- 340	513	1026	300	165.9	165.9	300	167.5	190.1
			400	165.9	165.9	400	190.1	190.1
			500	165.9	165.9	500	190.1	190.1
RLA 20- 500	753	1506	300	165.9	165.9	300	167.5	190.1
			400	165.9	165.9	400	190.1	190.1
			500	165.9	165.9	500	190.1	190.1

Reinforcements 1 and 2 according to chapter 5.2.1.

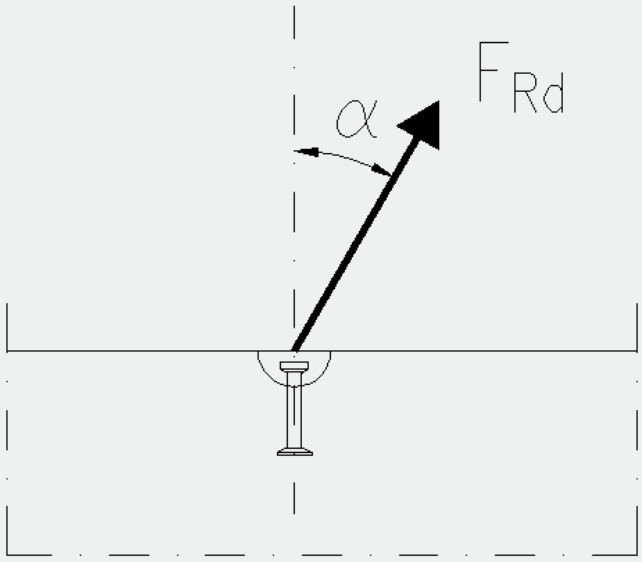


FIGURE 4 | *Lifting angle α*

Greatest allowed lifting angle α is 60°.

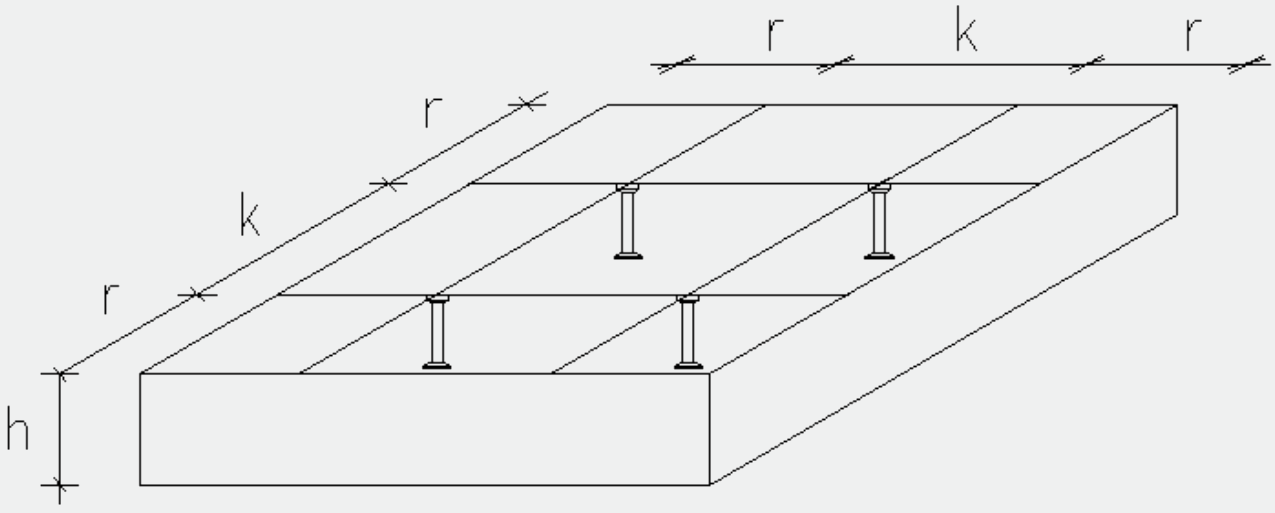


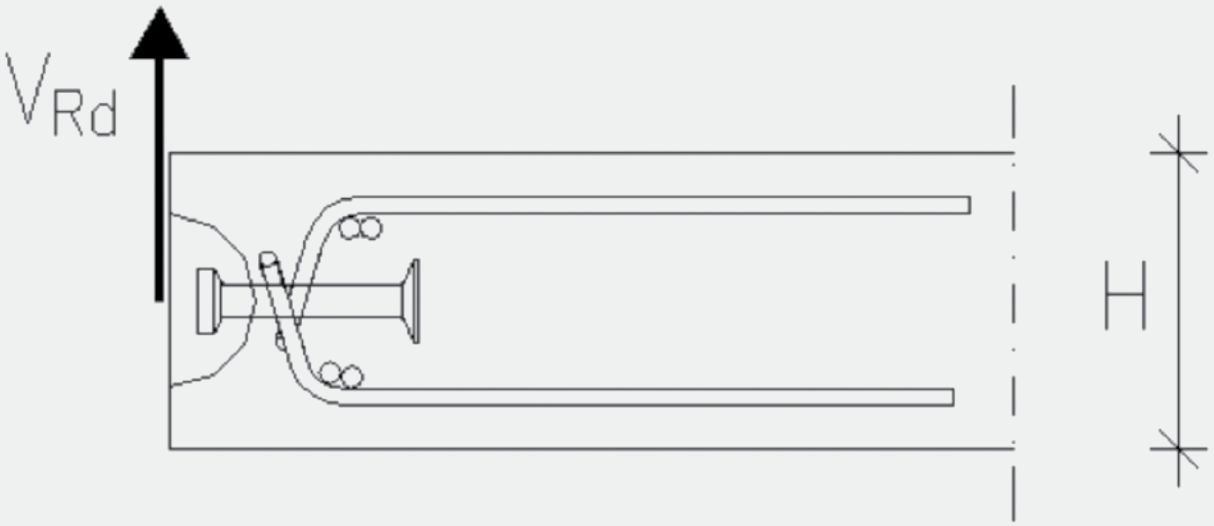
FIGURE 5 | *RLA lifting anchor in slab*

TABLE 5 | RESISTANCES AND EDGE DISTANCES IN SLAB STRUCTURES WHEN α = 0 - 45°

Lifting anchor	Slab minimum thickness h [mm]	Edge distance r [mm]	Center distance k [mm]	Resistance F_{Rd} [kN] with reinforcement 1		Resistance F_{Rd} [kN] with reinforcement 2	
				C16/20	C25/30	C16/20	C25/30
RLA 1.3- 40	70	72	144	3.7	4.6	7.2	9.7
RLA 1.3- 50	80	87	174	5.3	6.5	9.8	12.6
RLA 1.3- 65	95	110	219	8.2	10.0	12.6	12.6
RLA 1.3- 85	115	140	279	12.6	12.6	12.6	12.6
RLA 1.3- 120	150	192	384	12.6	12.6	12.6	12.6
RLA 2.5- 55	85	93	186	6.0	7.4	10.9	14.6
RLA 2.5- 65	95	108	216	8.0	9.8	13.4	18.1
RLA 2.5- 85	115	138	276	12.9	15.8	18.6	24.4
RLA 2.5- 120	150	191	381	21.8	24.4	24.4	24.4
RLA 2.5- 170	200	266	531	24.4	24.4	24.4	24.4
RLA 4.0- 75	105	123	246	10.3	12.6	21.4	28.8
RLA 4.0- 100	130	161	321	16.8	20.6	30.0	40.4
RLA 4.0- 120	150	191	381	21.8	26.7	36.9	40.6
RLA 4.0- 170	200	266	531	35.8	36.9	40.6	40.6
RLA 4.0- 210	240	326	651	36.9	36.9	40.6	40.6
RLA 4.0- 340	370	521	1041	36.9	36.9	40.6	40.6
RLA 5.0- 85	115	138	276	12.9	15.8	31.0	41.8
RLA 5.0- 95	125	153	306	15.7	19.2	35.3	47.6
RLA 5.0- 120	150	191	381	21.8	26.7	46.1	50.3
RLA 5.0- 180	210	281	561	38.9	47.6	50.3	50.3
RLA 5.0- 240	270	371	741	50.3	50.3	50.3	50.3
RLA 7.5- 100	130	158	315	16.4	20.0	36.6	49.3
RLA 7.5- 120	150	188	375	21.3	26.0	45.2	60.9
RLA 7.5- 140	170	218	435	26.5	32.5	53.9	72.5
RLA 7.5- 165	195	255	510	33.7	41.3	64.6	72.7
RLA 7.5- 200	230	308	615	44.6	54.7	72.7	72.7
RLA 7.5- 300	330	458	915	57.6	57.6	72.7	72.7
RLA 10- 115	145	179	357	19.7	24.2	51.2	68.9
RLA 10- 135	165	209	417	24.9	30.5	61.5	82.8
RLA 10- 150	180	231	462	29.1	35.6	69.3	93.3
RLA 10- 170	200	261	522	34.9	42.7	79.6	99.1
RLA 10- 250	280	381	762	61.6	75.4	99.1	99.1
RLA 10- 340	370	516	1032	82.9	82.9	99.1	99.1
RLA 15- 140	170	215	431	26.1	32.0	63.9	86.0
RLA 15- 165	195	253	506	33.3	40.7	76.8	103.4
RLA 15- 200	230	305	611	44.1	54.1	94.9	127.8
RLA 15- 300	330	455	911	80.4	82.9	146.6	146.6
RLA 15- 400	430	605	1211	82.9	82.9	146.6	146.6
RLA 20- 200	230	303	606	43.7	53.5	141.2	190.1
RLA 20- 240	270	363	726	57.2	70.1	172.2	190.1
RLA 20- 250	280	378	756	60.8	74.5	179.9	190.1
RLA 20- 340	370	513	1026	96.2	117.8	190.1	190.1
RLA 20- 500	530	753	1506	165.9	165.9	190.1	190.1

Reinforcements 1 and 2 according to chapter 5.2.1.

4.5 RESISTANCES IN SIDE LIFTING



Reinforcement in side lifting according to chapter 5.2.3..

TABLE 6 | RESISTANCE AND ELEMENT THICKNESS IN SIDE LIFTING

Lifting anchor	Concrete minimum thickness H [mm]	Resistance V_{Rd} [kN] with reinforcement (chapter 5.2.3) C16/20 and C25/30
RLA 1.3- 40	60	3.6
RLA 1.3- 50	60	4.9
RLA 1.3- 65	60	6.3
RLA 1.3- 85	60	6.3
RLA 1.3- 120	60	6.3
RLA 2.5- 55	80	5.4
RLA 2.5- 65	80	6.7
RLA 2.5- 85	80	9.3
RLA 2.5- 120	80	12.2
RLA 2.5- 170	80	12.2
RLA 4.0- 75	120	10.7
RLA 4.0- 100	100	15.0
RLA 4.0- 120	100	18.4
RLA 4.0- 170	100	20.3
RLA 4.0- 210	100	20.3
RLA 4.0- 340	100	20.3
RLA 5.0- 85	160	15.5
RLA 5.0- 95	160	17.7
RLA 5.0- 120	160	23.1
RLA 5.0- 180	160	25.1
RLA 5.0- 240	160	25.1
RLA 7.5- 100	160	18.3
RLA 7.5- 120	160	22.6
RLA 7.5- 140	160	26.9
RLA 7.5- 165	160	32.3
RLA 7.5- 200	160	36.3
RLA 7.5- 300	160	36.3

Lifting anchor	Concrete minimum thickness H [mm]	Resistance V_{Rd} [kN] with reinforcement (chapter 5.2.3) C16/20 and C25/30
RLA 10- 115	200	25.6
RLA 10- 135	200	30.8
RLA 10- 150	200	34.6
RLA 10- 170	200	39.8
RLA 10- 250	200	49.6
RLA 10- 340	200	49.6
RLA 15- 140	300	31.9
RLA 15- 165	300	38.4
RLA 15- 200	300	47.4
RLA 15- 300	300	73.3
RLA 15- 400	300	73.3
RLA 20- 200	300	70.6
RLA 20- 240	300	86.1
RLA 20- 250	300	90.0
RLA 20- 340	300	95.1
RLA 20- 500	300	95.1

Reinforcement in side lifting according to chapter 5.2.3.

5 APPLICATION OF RLA LIFTING ANCHORS

5.1 LIMITATIONS FOR APPLICATION

Strength of concrete during lifting must be at least C16/20 or C25/30.
Reinforcement according to 5.2 must be placed in the element.

Only suitable and fitting lifting devices can be used in lifting. If lifting angle **α** is greater than 45° lifting device with pressure plate must be used. Resistance of lifting device must at least the same as the RLA lifting anchors resistance.

Greatest allowed lifting angle **α** is 60°.

5.2 REINFORCEMENT

Element must be reinforced to transfer all loads reliably from the RLA lifting anchor to the element. At least minimum reinforcement according to Euorcodes must be provided.

5.2.1 Anchoring reinforcement

The concrete element at the RLA lifting anchors must always be reinforced according to figures 7 (slab) or 8 (wall) and table 7.

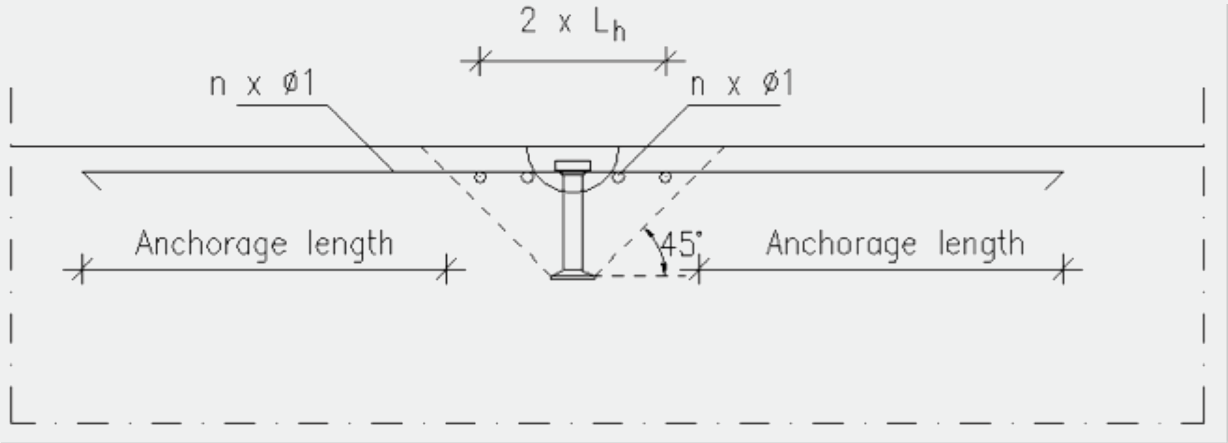


FIGURE 7 | *Anchoring reinforcement in slab (see table 6)*

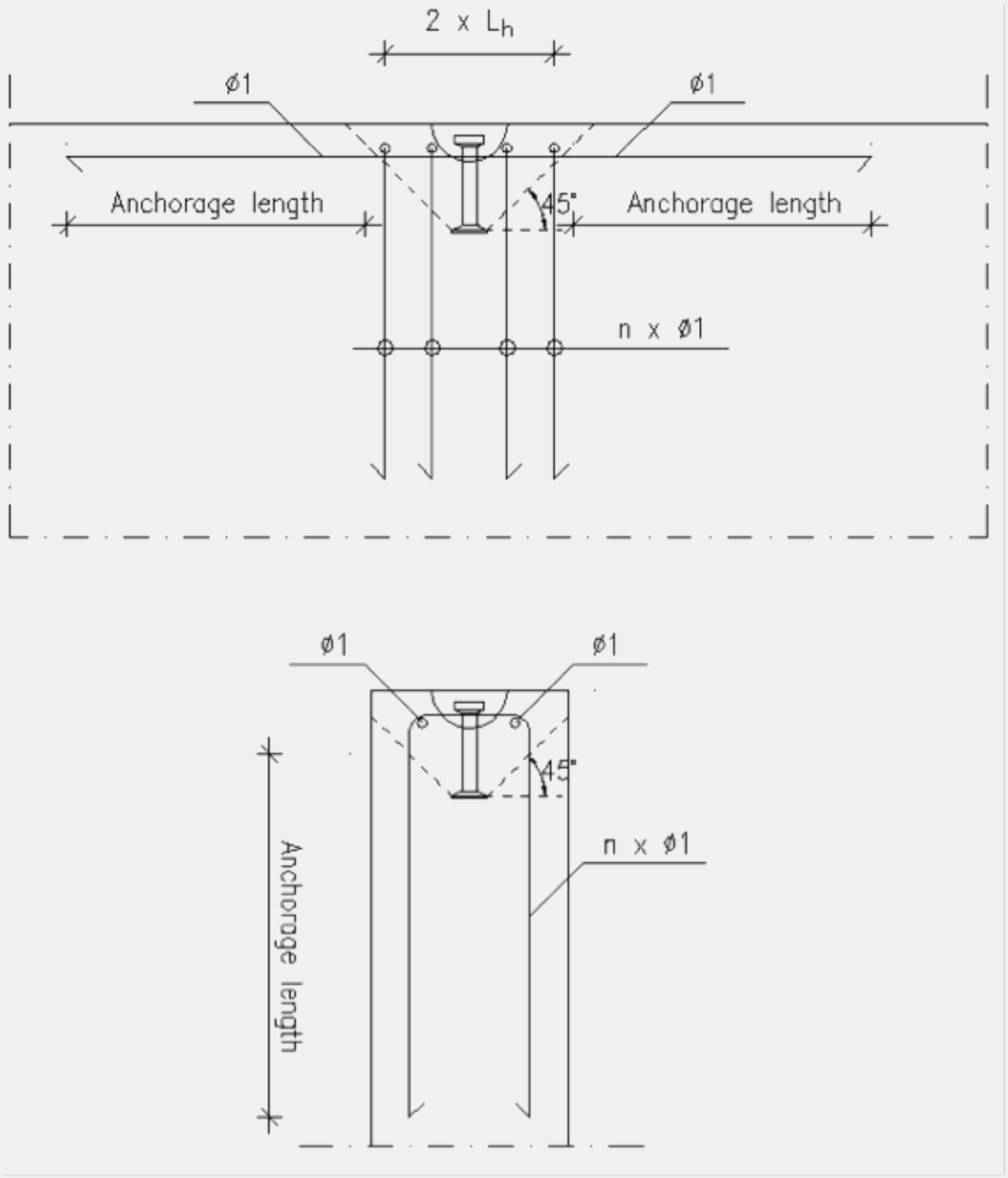


FIGURE 8 | *Anchoring reinforcement in wall (see table 6)*

TABLE 7 | ANCHORING REINFORCEMENT IN STRAIGHT LIFT

Lifting anchor	Anchoring reinforcement in straigth lift				Additional reinforcement in angled lift (see figure 8)
	Reinforcement 1 Ø1 [mm]	n [pcs]	Reinforcement 2 Ø2 [mm]	n [pcs]	Ø2 [mm]
RLA 1.3- 40 RLA 1.3- 50 RLA 1.3- 65 RLA 1.3- 85 RLA 1.3- 120	6	2	6	4	6
RLA 2.5- 55 RLA 2.5- 65 RLA 2.5- 85 RLA 2.5- 120 RLA 2.5- 170	8	2	8	4	8
RLA 4.0- 75 RLA 4.0- 100 RLA 4.0- 120 RLA 4.0- 170 RLA 4.0- 210 RLA 4.0- 340	8	2	8	4	8
RLA 5.0- 85 RLA 5.0- 95 RLA 5.0- 120 RLA 5.0- 180 RLA 5.0- 240	10	2	10	4	10
RLA 7.5- 100 RLA 7.5- 120 RLA 7.5- 140 RLA 7.5- 165 RLA 7.5- 200 RLA 7.5- 300	10	2	10	4	12
RLA 10- 115 RLA 10- 135 RLA 10- 150 RLA 10- 170 RLA 10- 250 RLA 10- 340	12	2	12	4	16
RLA 15- 140 RLA 15- 165 RLA 15- 200 RLA 15- 300 RLA 15- 400	12	2	12	4	20
RLA 20- 200 RLA 20- 240 RLA 20- 250 RLA 20- 340 RLA 20- 500	12	4	12	6	20

5.2.2 Additional reinforcement in angled lift

When lifting angle α is greater than 25°, additional reinforcement according to figure 9 and table 7 is necessary. This is installed in addition to anchoring reinforcement according to 5.2.1.

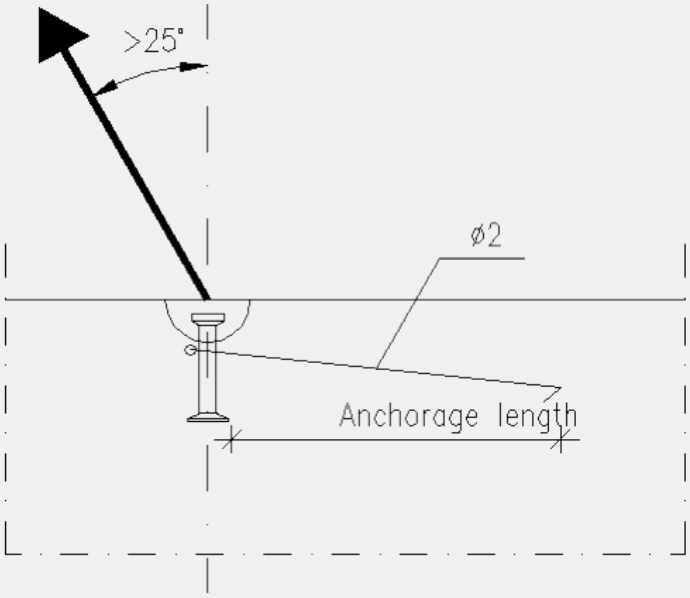


FIGURE 9 | *Additional reinforcement in angled lift*

5.2.3 Additional reinforcement in side lifting

In side lifting additional reinforcement according to figure 10 and table 8 is necessary.

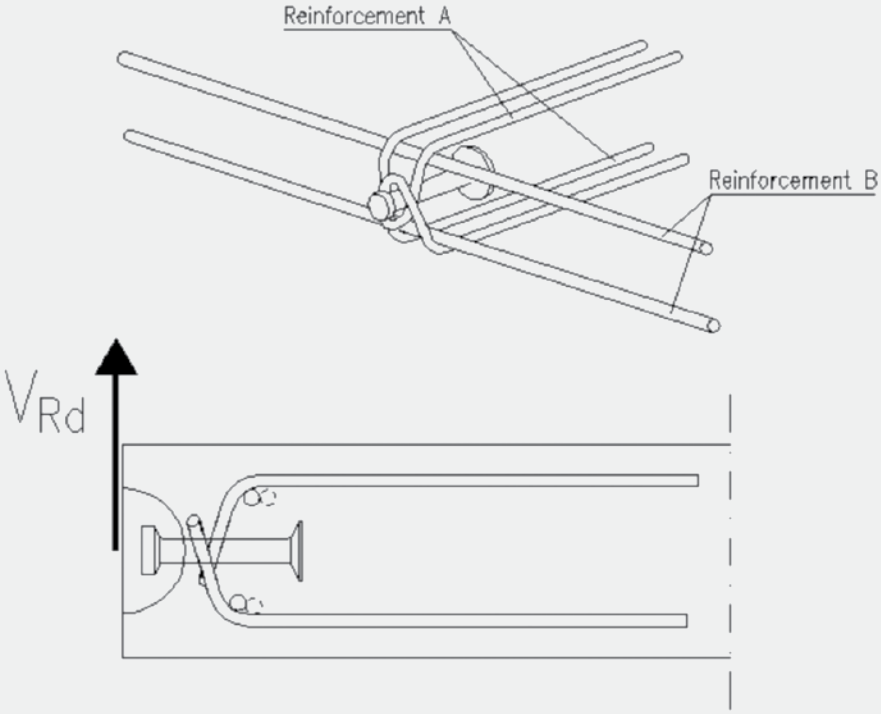


FIGURE 10 | *Additional reinforcement in side lifting*

TABLE 8 | ADDITIONAL REINFORCEMENT IN SIDE LIFTING

Lifting anchor	Additional reinforcement in side lift			
	Reinforcement A		Reinforcement B	
	ØA [mm]	n [pcs]	ØB [mm]	n [pcs]
RLA 1.3- 40 RLA 1.3- 50 RLA 1.3- 65 RLA 1.3- 85 RLA 1.3- 120	6	1	10	1
RLA 2.5- 55 RLA 2.5- 65 RLA 2.5- 85 RLA 2.5- 120 RLA 2.5- 170	6	1	12	1
RLA 4.0- 75 RLA 4.0- 100 RLA 4.0- 120 RLA 4.0- 170 RLA 4.0- 210 RLA 4.0- 340	8	1	16	1
RLA 5.0- 85 RLA 5.0- 95 RLA 5.0- 120 RLA 5.0- 180 RLA 5.0- 240	8	1	12	2
RLA 7.5- 100 RLA 7.5- 120 RLA 7.5- 140 RLA 7.5- 165 RLA 7.5- 200 RLA 7.5- 300	10	1	16	2
RLA 10- 115 RLA 10- 135 RLA 10- 150 RLA 10- 170 RLA 10- 250 RLA 10- 340	10	1	20	2
RLA 15- 140 RLA 15- 165 RLA 15- 200 RLA 15- 300 RLA 15- 400	12	1	20	2
RLA 20- 200 RLA 20- 240 RLA 20- 250 RLA 20- 340 RLA 20- 500	12	1	25	2

5.3 RESISTANCES IN ANGLED LIFTING

Loads applied to RLA lifting anchors are increased in angled lifting. This increase is taken into account by factor z, by which the element weight G multiplied. In angled lifting the RLA lifting anchors must be designed for this load.

Force F is divided to the RLA lifting anchors working in the lifting. Force applied to one RLA lifting anchor depends on type of lifting, placement of the element and lifting angle.

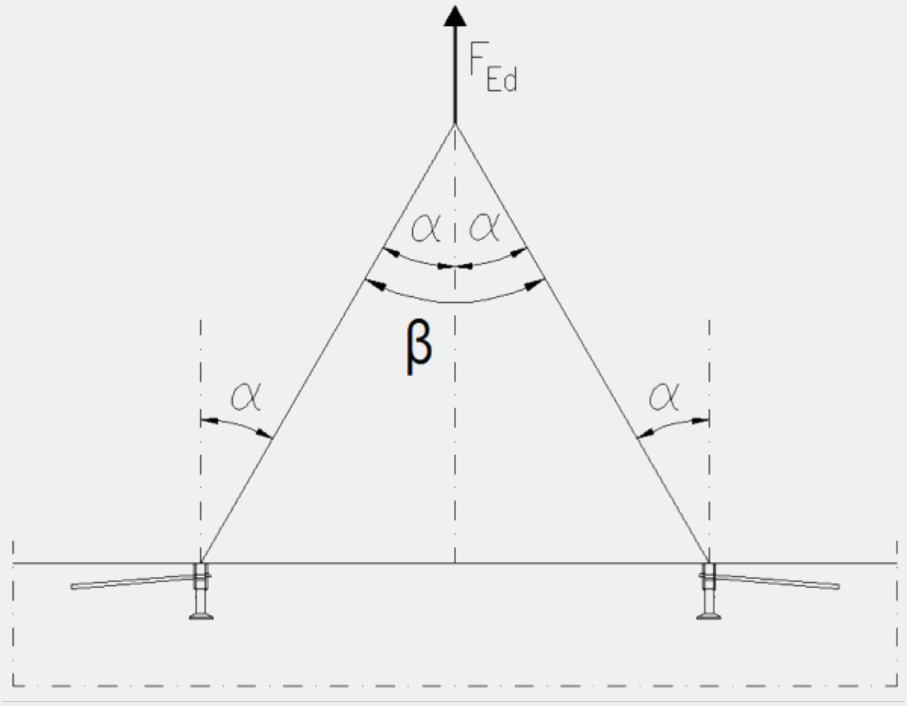


FIGURE 11 | *Lifting angle α*

$$F_{Ed} = \frac{\gamma_{load} \cdot G}{n_{anchor}} \cdot z$$

$\gamma_{load} = 1{,}0$
n_{anchor} = number of anchor working in the lifting

TABLE 9 | FACTOR Z

Top angle β	Lifting angle α	Factor z
120°	60°	2,00
90°	45°	1,41
60°	30°	1,16
45°	22,5°	1,08
30°	15°	1,04
0°	0°	1,00

5.4 DESIGN EXAMPLE

Slab element weight is G = 28 kN, slab thickness 180 mm, concrete strength at the time of lifting C16/20. Slab is designed to be lifted with four RLA lifting anchors. In slab element lifting three lifting anchors may be presumed to be working during lifting. Lifting angle α = 30°, load for one RLA lifting anchor is calculated as follows $F_{Ed.1} = 1.0 \cdot 28kN3 \cdot 1{,}16 = 10{,}8kN$.

According to table 5 four RLA2.5-120 lifting anchors with edge distance ≥ 191 mm and center distance ≥ 381 mm are chosen. Resistance of one lifting anchor is F_{Rd} = 12,4 kN.

6 INSTALLATION

RLA lifting anchor must be attached securely so it cannot move during casting of the concrete. At the RLA lifting anchor the concrete must be compressed carefully. RLA lifting anchor cannot be vibrated.

7 SUPERVISION OF ASSEMBLY

Check list before casting:

- RLA lifting anchor is in good condition
- RLA lifting anchor is according to designs and in the right place
- RLA lifting anchor is attached firmly
- the required additional reinforcement is assembled

During the casting:

- RLA lifting anchor stays in the right place
- concrete is thoroughly vibrated around the RLA lifting anchor

After the casting:

- the situation of the RLA lifting anchor is according to design

8 LIFTING CLUTCH

8.1 LIFTING CLUTCH DESCRIPTION

3D Lifting System TH2 can be used with RLA lifting anchors. The 3D Lifting System TH2 is made of high quality steel and they are designed with a safety factor 3 times the working load. The special design of the clutch ensures a tight and safe connection to the RLA lifting anchor. The shackle fits the hemispherical cavity created by the recess former perfectly. The lifting clutch, recess former and lifting anchor only correspond when they are from the same load group. The load group is clearly marked on the lifting clutch.

8.2 LIFTING CLUTCH DIMENSIONS

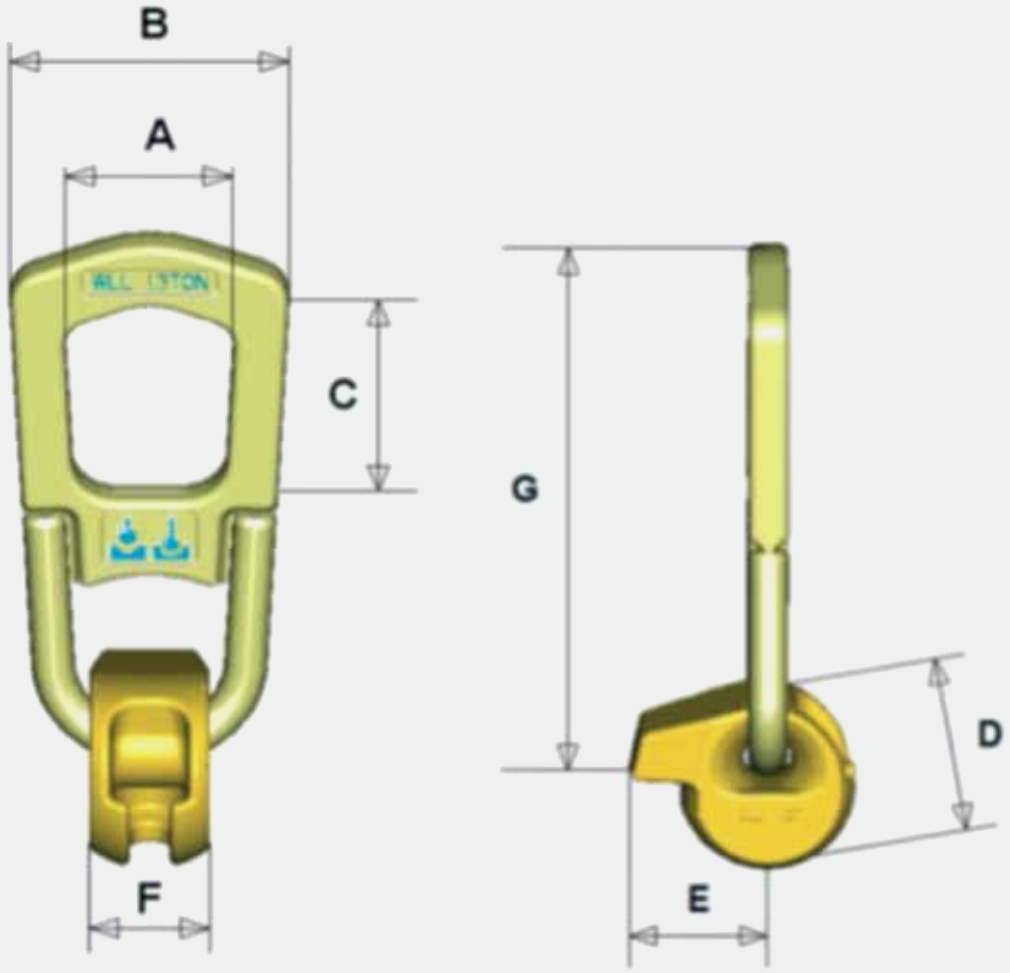


FIGURE 12 | *Lifting clutch*

TABLE 10 | LIFTING CLUTCH DIMENSIONS

TH2 Zinc Plated Type	Product no.	Load group [t]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	Weight [kg/pc]
TH2 13	43143	1,3	48	77	60	55	40	33	165	0,944
TH2 25	43144	2,5	50	92	75	68	55	42	205	1,770
TH2 40/50	43145	5,0	68	121	86	88	64	57	240	3,795
TH2 75/100	43146	10,0	84	170	110	108	90	77	346	9,390
TH2 150/200	43147	20,0	124	230	140	146	118	115	520	25,315
TH2 320	43148	32,0	155	303	175	195	160	155	590	50,400
TH2 450	44500	45,0	155	303	175	195	160	155	590	50,400

8.3 LIFTING CLUTCH LOAD GROUPS

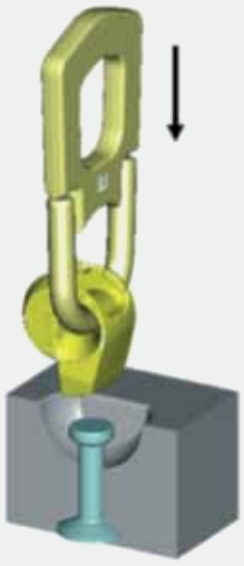
When using 3D Lifting System TH2 with RLA lifting anchors, sufficient capacity of the lifting clutch must be ensured from table 9 and compared to RLA lifting anchor resistance in tables 4, 5 and 6.

Suitability of the lifting clutch and the RLA lifting anchor depends on the dimensions defined by the load group. The load group of RLA lifting anchors is presented in the name of the RLA lifting anchor. Eg. RLA lifting anchor RLA 5.0-120, load group in tons is 5,0 and suitable lifting clutch type is TH2 40/50.

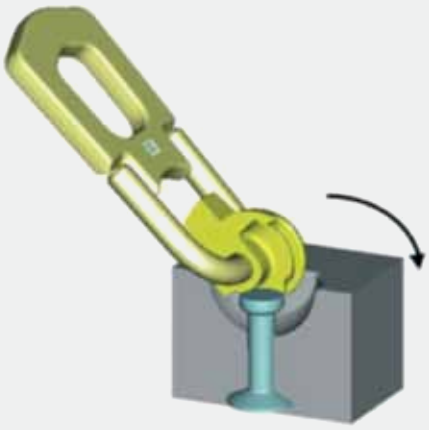
TABLE 11 | LIFTING CLUTCH LOAD GROUPS

TH2 Zinc Plated Type	Product no.	Load group [t]	[kN]
TH2 13	43143	1,3	13,0
TH2 25	43144	2,5	25,0
TH2 40/50	43145	5,0	50,0
TH2 75/100	43146	10,0	100,0
TH2 150/200	43147	20,0	200,0
TH2 320	43148	32,0	320,0
TH2 450	44500	45,0	450,0

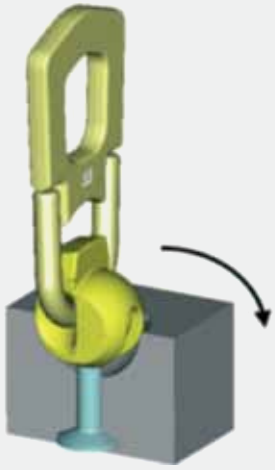
8.4 OPERATING INSTRUCTIONS



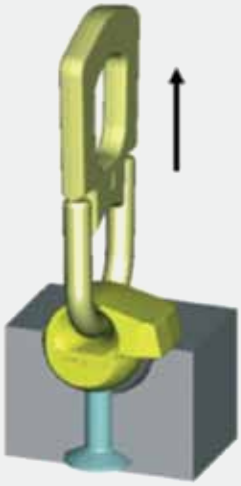
1. The clutch is brought to the right position.



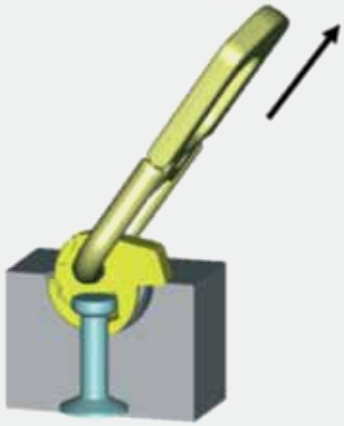
2. Rotate the shackle until the opening corresponds with the anchor head.



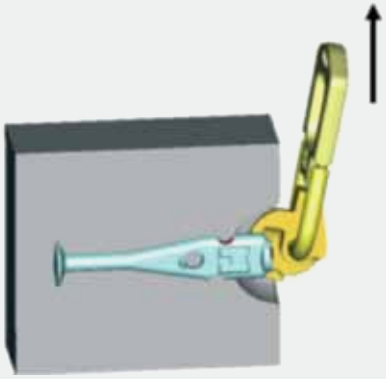
3. The shackle rotates to its locking position.



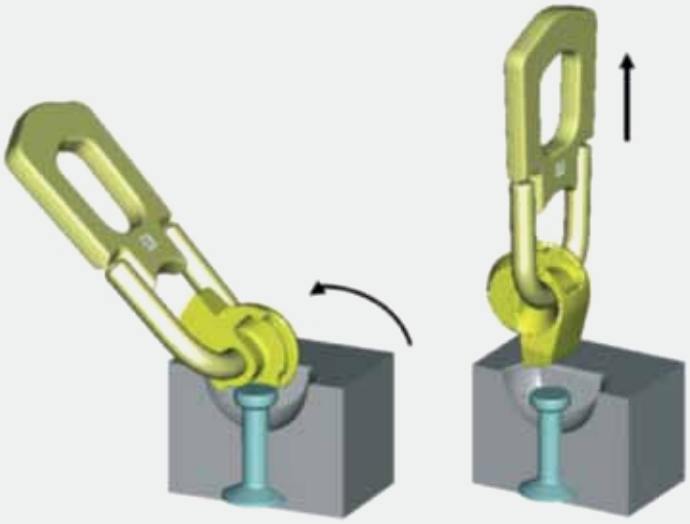
4. The nose of the shackle is pushed against the concrete element.



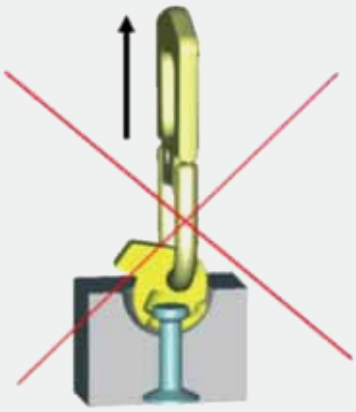
5. The concrete element can now be lifted.



When pitching the concrete unit with the 3D Lifting System, the nose must be in the same direction with the load.



Due to the counterweight of the nose, the shackle remains connected, even in an unloaded state. To release the 3D Lifting System, the load hook is lowered and the shackle is turned up and out. Only after the Lifting System is completely detached of the recess and the anchor, the carne can be withdrawn. The 3D Lifting System can remain attached to the crane hook till another use.



If the shackle remains in the position showed above, the lifting of the concrete unit is not possible.

R-STEEL®

R-Group Finland Oy
PL 37 | FIN-57101 Savonlinna | FINLAND
Tel. +358 20 722 9420
Fax. +358 20 722 9421
www.rsteel.fi
www.repo.fi